

Identification of the Spatial-Physical Components of Spaciousness Quality in the Interior Space of Apartment Housing Based on Experts' Perspectives*

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Received 24 January 2025; Revised 11 June 2025; Accepted 01 October 2025; Available Online 26 November 2025

ABSTRACT

Urbanization, rising land prices, and construction costs have led to a reduction in interior spatial dimensions in residential environments. The importance of considering the interior space of housing to meet residents' needs is unquestionable; meanwhile, most of today's living spaces in cities are apartments, small, with limited spatial dimensions. The significant reduction in the quantitative dimensions of apartments makes spacious, open residential interior spaces desirable. One of the spatial qualities that makes the interior space larger and creates satisfaction among apartment dwellers is the use of spaciousness quality and its components. The focus of the present study is to understand the influential components of spaciousness quality in order to improve the interior space of apartment dwellings from the perspective of experts. Accordingly, this research follows an exploratory approach and employs a mixed-method (quantitative and qualitative) strategy. The statistical population consists of 20 faculty members in architecture and experts in environmental psychology, and sampling is conducted using a combined theoretical and snowball sampling approach, with theoretical sampling used primarily for the initial participants and snowball sampling for subsequent participants. This research was carried out in three stages: in the first stage, based on library studies, the spatial-physical components associated with spaciousness quality were identified. In the second stage, using the Delphi method, a two-round expert questionnaire was completed. In the third stage, the data from the second-round questionnaire were evaluated using exploratory factor analysis (Q), along with KMO and Bartlett's tests, in SPSS-26. The findings indicate that using spatial-physical components, such as spatial lighting, views toward open space, spatial openness, flexibility, organization of openings, spatial continuity, and floor-ceiling proportions, improves the quality of interior space for residents.

Keywords: Spaciousness Quality, Apartment Housing, Interior Space, Exploratory Factor Analysis.

* This article is taken from the first author's doctoral dissertation entitled "Assessment of Residents' Satisfaction in Apartment Housing Based on Spaciousness Components (Case Study: Common Apartments in Borujerd City)," which was conducted with the guidance of the second author and the advice of the third author at Isfahan University of Art in 2025.

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1. INTRODUCTION

Urban population growth, on the one hand, and the inability to provide sufficient land and the high cost of supplying urban infrastructure, on the other, have led policymakers, planners, and residential environment designers to turn to vertical development and increased density (Madani, Pourdeihimi, and Mousavinia 2017). The first consequence of this process is the reduction of interior space dimensions, which represent the most influential spatial level in residential environments (interior space, building structure, and neighborhood unit) in relation to residents (Brkanic 2023, 38). Meanwhile, environmental psychology studies on residential environments and their inhabitants have demonstrated that individuals avoid and are dissatisfied with cramped spaces (De Macedo, Walbe Ornstein, and Azambuja Elali 2023). There exist indicators for evaluating the desirability of enclosed interior spaces—particularly apartment housing—and one of the influential indicators is the use of spaciousness quality. Spaciousness quality seeks to create interior spatial desirability for residents through introducing changes to the physical components of space (Diker and Demirkan 2022, 3).

Considering the importance of understanding spaciousness quality and its influential components in relation to enclosed interior spaces, previous studies addressing spaciousness quality have mainly focused on physical components (Tural and Tural 2024; Nishihara et al. 2023; AL Zamil 2017; Stamps 2013), while much less attention has been given to spatial components influencing spaciousness quality. This is despite the reality that the physical shell of the house is constructed to shape its unbuilt interior—namely, space itself. In fact, what matters about the physical structure is improving its elements to meet residents' needs, ultimately leading to addressing those needs and building suitable housing for them (Asgharkhah Farkhani et al. 2024).

Given the explained necessity of paying attention to improving the quality of the interior space of apartment housing based on the components of spaciousness quality, the present study was written from the perspective of experts to improve the quality of the interior space of apartment housing with the help of the spaciousness physical components of spatial quality. It attempts to determine, based on

the opinions of experts and designers in the field of housing, the spaciousness physical components that affect the quality of the interior space of apartment housing, which lead to the improvement of the quality of the interior space of apartment housing. Thus, the main question of the present study is:

What are the spatial-physical components that influence spaciousness quality from experts' perspectives?

1.1. Research Background

Considering the research domain, which concerns improving housing quality, previous studies can be categorized into two groups according to the study's objectives (Fig. 1):

A. Understanding factors influencing the improvement of residential environment quality, particularly the interior space of apartment housing (Howden-Chapman et al. 2023; Wimalasena et al. 2021; Mouratidis 2021; Short and Bassett 2021; Glaeser and Gyourko 2018; Sima 2015; Zanuzdana 2013; Ghalambardzfuli, Taghizadeh, and Majedi 2018; Rezaei Khaboushan and Nemati Mehr 2021).

In these studies, influential dimensions such as physical program (floor area and size, spatial dimensions, number of rooms), plan layout (geometry and proportions of the plan, zoning of public and private spaces, spatial organization, and flexibility), environmental health and comfort (openings, lighting and ventilation, insulation), spatial experience (presence of open and semi-open spaces, visual quality, and views), building structure (materials, construction strength and technology, quality of mechanical systems), and aesthetics (facade, interior architectural form, and decorations) have been investigated to understand dimensions contributing to improved quality of residential environments (and rarely the interior of housing).

B. Identification of spaciousness quality components in interior spaces: (Nishihara et al. 2023; Wang, Ryuzo Ohno, and Gu 2020; AL Zamil 2017; Bokharai 2023; 2015; Bokharai and Nasar 2016; Von Castell et al. 2014; Ozdemir 2010; Stamps 2005; 2007; 2011; 2013). Studies in the second group have, to a limited extent, only introduced the physical components influencing spaciousness quality in various spatial typologies (rooms, galleries, streets, etc.).

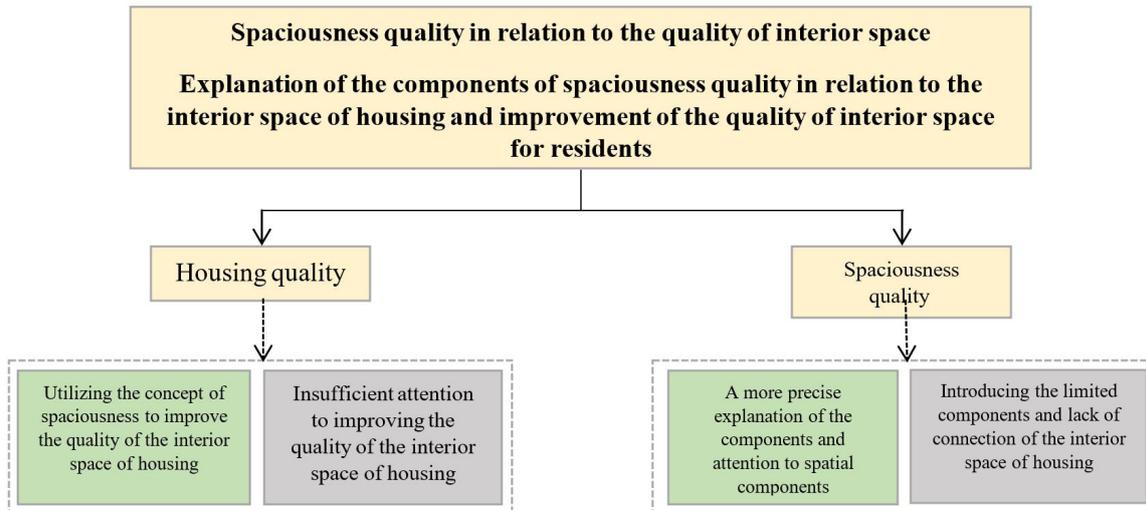


Fig. 1. Axes of the Research Background Related to the Study Topic

Based on the research background presented earlier, enhancing the quality of interior housing spaces has rarely been given due attention, and researchers have generally focused on components related to building quality (rather than interior residential space). Regarding spaciousness quality (in both domestic and international studies), only a limited number of physical components influencing spaciousness quality have been introduced, and not specifically in relation to interior residential spaces. Meanwhile, one of the fundamental goals in housing is to address residents' spatial needs to ensure desirable living conditions. The present study, therefore, seeks to identify the spatial-physical components influencing spaciousness quality that can improve interior housing space quality from the viewpoint of experts.

2. THEORETICAL FOUNDATIONS

The importance of considering interior housing space to respond to residents' needs is widely acknowledged; one of the major critiques in improving residential environments concerns the lack of attention to interior space and the minimal emphasis placed on it (Stevenson and Prout 2013, 142). In fact, what improves the quality of residential environments and enhances resident satisfaction is careful attention to the interior of housing spaces, which enables internal modifications based on residents' needs, because the primary function of housing is to create a desirable and enjoyable space for its inhabitants (Perolini 2011, 5). There are several indicators for assessing the desirability of interior apartment housing space, and one influential indicator is the use of spaciousness quality. Spaciousness refers to a spatial quality that makes interiors appear more expansive and contributes to residents' satisfaction (Stamp 2013, 866).

Paying attention to the cognate and synonym

meanings of the word spaciousness in different dictionaries allows us to discover more aspects of its lexical meanings and, as a result, the position of the word spaciousness in different categories. According to the Oxford Dictionary, the term is mainly used for rooms and buildings and refers to an ample, expansive space. The Collins Dictionary considers a spacious place to be one that has high capacity and breadth. The Cambridge Dictionary defines spaciousness as a large place with a considerable amount of space. The American Heritage Dictionary defines spaciousness as largeness and breadth in area and space, equating it with capacity. The New World Dictionary characterizes a spacious place as free, wide, large, with abundant space and volume. With these lexical definitions of the concept of spaciousness, it is understood that spaciousness is a spatial quality that depends on the extent and capacity of space and, in terms of spatial capacity, inspires something different from reality in the mind. In other words, the wider and larger the space appears, the more spacious it is.

The following section presents the components influencing the creation of spaciousness quality in interior spaces (in this study, apartment interior spaces), derived through a review of primary sources and texts (Table 1). As stated in the research background, previous studies on spaciousness quality (interior and exterior) have examined only a limited set of physical components influencing spaciousness quality, and not specifically in the context of interior spaces. In the present research, in addition to physical components, spatial components influencing the improvement of interior spatial quality in apartment housing are also considered. Therefore, to attain a richer understanding of the components influencing spaciousness quality, this study takes into account both the physical components extracted from credible documents and sources and the spatial components that enhance the interior quality of housing.

Table 1. Spatial-Physical Components related to Spaciousness Quality

Spatial Physical Component	Row	Component Names	References
Physical Components	1	Space Area	(Stamps 2007; 2011; 2013)
	2	Space Lighting	(AlZamil 2017; Unlu et al. 2022)
	3	Floor Proportions	(Stamps 2011)
	4	Space Wall Roughness	(Stamps and Krishnan 2006)
	5	Space Height	(Hayward and Franklin 1974)
	6	Space Wall Permeability	(Stamps 2005; 2009)
	7	Furniture Arrangement	(Meagher and Marsh 2015)
	8	Wall Texture	(Wang, Ryuzo Ohno, and Gu 2020; Unlu et al. 2022)
	9	Opening Placement	(Nishihara et al. 2023)
Spatial Components	10	Flexibility	(Gharavi Alkhansari 2018)
	11	Spatial Hierarchy	(Ching 2021; Van Meiss 2011)
	12	Spatial Relationships	(Alexander 2017; Mirsalami, Omranipour, and Khoshbakht Bahramani 2020)
	13	Spatial Guidance and Orientation	(Haeri 2016)
	14	Space Proportions and Scale	(Alexander 2017)
	15	Harmony and Balance	(Ching 2021; Van Meiss 2011)
	16	Spatial Composition	(Haeri 2016)
	17	Spatial Continuity	(Golestania, Hojat, and Saedvandi 2017)
	18	Spatial Separation	(Haeri 2016)
	19	Optical Expansion of Space	(Haeri 2016; Norberg-Schulz 2003)
	20	Expansion of Space Perspective	(Haeri 2016; Norberg-Schulz 2003)
	21	Spatial Differentiation	(Alexander 2017)
	22	Spatial Diversity	(Haeri 2016)
	23	Spatial Expansion	(Haeri 2016)
	24	Spatial Openness	(Haeri 2016)
	25	Spatial Dynamics	(Haeri 2016; Memarian 2005)

Based on the studies conducted in the present research, the components influencing spaciousness quality were initially identified. The proposed components are categorized into two groups: physical and spatial. The physical components (Items 1 to 9) were extracted from a review of sources on spaciousness. The spatial components (Items 10 to 25) were identified through a review of related sources and consultation with experts in environmental psychology. The refinement process of these components is explained later in the research methodology section.

3. METHOD

The present study is exploratory in nature, aiming to expand the topic beyond what already exists in the related literature, and employs a mixed-method approach. Given the complex and multidimensional nature of the subject—which relies on understanding

the spatial-physical components influencing spaciousness quality to improve interior spaces of apartment housing—this research is fundamental in its purpose. From a methodological perspective, the present study is divided into three main parts. The first part consists of library and documentary studies. In this stage, relevant sources and previous research were consulted to identify the concept of spaciousness quality, the physical components influencing it, and the spatial components affecting spaciousness quality, for the purpose of evaluating them. The second part of the research employs the Delphi method in two stages to refine the spatial-physical components influencing spaciousness quality based on the viewpoints of experts and designers. The expert group consisted of 20 faculty members from universities across Iran, as well as specialists in architecture and environmental psychology with experience in housing design. Sampling in the Delphi stage was purposeful,

combining theoretical sampling—particularly for the initial participants—and snowball sampling for the subsequent participants. Sample selection continued until theoretical saturation was reached.

The first round of the Delphi method, as outlined in the operational structure of this technique, used an open-ended questionnaire and a three-point continuum. The first-round Delphi questionnaire aimed to eliminate spatial-physical components unrelated to spaciousness quality that had been extracted from the literature. The three-point continuum was rated as follows: essential (score 3), helpful but not essential (score 2), and not crucial (score 1). Additionally, experts were asked to mention any components related to spaciousness quality that had not been included in the questionnaire. To determine the spatial-physical components most strongly associated with spaciousness quality based on experts' viewpoints in the first Delphi round, the Content Validity Ratio (CVR) was used. According to Lawshe's Table (Lawshe 1975), for a component to be acceptable with 20 respondents, the minimum

CVR value must be 0.42. After completing the first Delphi round, 9 of the 25 spatial-physical components identified from the literature on spaciousness quality were eliminated. For the second Delphi round, based on the 16 remaining spatial-physical components, a closed-ended questionnaire using a 10-point Likert scale (0-9) was developed, comprising 50 items. The 50-item researcher-constructed questionnaire was designed to include at least two of the three domains—cognitive, emotional, and behavioral—to incorporate diverse expert perspectives. In the second Delphi round, the reliability (Gifford 2018) and validity (Pashasharifi and Sharifi 2020) of this closed-ended researcher-constructed questionnaire were evaluated.

The reliability of the questionnaire, consisting of 50 items and 20 responses, was assessed using Cronbach's alpha in SPSS Version 26. The items achieved a Cronbach's alpha coefficient of 0.962, indicating excellent reliability (Table 2).

Table 2. Calculation of Cronbach's Alpha for the Researcher-Constructed Questionnaire in the Second Delphi Round

Reliability Statistics	
No. of Questions	Cronbach's Alpha
50	0.962

To assess the validity of the researcher-developed questionnaire, five architecture experts with prior research experience in housing and environmental psychology were consulted, and their evaluations and feedback were obtained. Through this process, the face validity and content validity of the questionnaire were confirmed.

The third part of the research involves categorizing concepts from the perspective of experts using exploratory factor analysis (Q) to explain the spatial-physical components of spaciousness quality. Before proceeding with the analysis, it is necessary to introduce the exploratory factor analysis method to understand the process better. In general, researchers consider exploratory factor analysis a "systematic study" of individuals' subjectivity and viewpoints. In this method, instead of identifying commonalities within a large population, the focus is placed on understanding individual subjectivities (Corr 2001, 297). Therefore, the researcher can uncover individuals' mental content on various topics.

This method is often described as a link between quantitative and qualitative research methods. On the one hand, the purposive selection of participants and the small sample size make it similar to qualitative methods; on the other hand, the findings are obtained entirely quantitatively through "factor analysis." Among the influencing factors for conducting an exploratory factor analysis of the received data are the assessment of sample adequacy using the KMO test and Bartlett's test of sphericity. The acceptable value for this test in determining sample adequacy and component extraction is 0.6 (Howard 2016, 52). In this research, the sample adequacy test values obtained from the KMO and Bartlett's tests are 0.748, which is acceptable (Table 3). Furthermore, since the significance level in this test is 0.00 or lower (MacCallum et al. 1999), an exploratory factor analysis of the questionnaire data is feasible. The stages of conducting the analysis and extracting the components are explained in the research findings section.

Table 3. KMO and Bartlett's Test Values for the Data of the Researcher-Made Questionnaire

Size KMO		0.748
Bartlett's Test of Sphericity	Chi-Square	419.098
	df	190
	Sig.	0.000

4. FINDINGS AND DISCUSSION

At the data analysis stage, the spatial-physical components extracted from the research literature were individually transformed into separate questionnaire items (25 questions corresponding to the elements identified in the literature review section). These items were presented to the experts, who were asked to determine the degree of correspondence between the questionnaire items and the spaciousness quality using a three-level scale: “essential,” “useful but not essential,” and “not essential.” After collecting the experts’ evaluations regarding the spatial-physical components with higher priority in relation to

spaciousness quality—based on the Content Validity Ratio (CVR) coefficient (Fig. 2)—it was determined that the components of spatial guidance and orientation, spatial relationships, spatial expansion, harmony and balance, wall texture, permeability of spatial boundaries, spatial proportions and scale, spatial dynamism, and spatial diversity had lower relevance to spaciousness quality and scored less than 0.42. Therefore, these components were excluded in the second round of the Delphi process and in the construction of the closed-ended, researcher-made questionnaire (Table 4).

$$CVR = \frac{\text{Number of specialists who selected the essential option} - \frac{\text{Total number of specialists}}{2}}{\frac{\text{Total number of specialists}}{2}}$$

Fig. 2. Process of Calculating the Content Validity Ratio

Table 4. Quantitative Results of the Content Validity Ratio for Selecting Components with Higher Priority related to Spaciousness Quality

Row	Physical Components of Space	CVR Indicator	Row	Physical Components of Space	CVR Indicator
1	Space Area	0.9	14	Space Wall Permeability	0.2
2	Space Lighting	1	15	Furniture Arrangement	0.8
3	Flexibility	0.8	16	Spatial Separation	0.7
4	Spatial Hierarchy	0.5	17	Optical Expansion of Space	0.6
5	Floor Proportions	0.6	18	Perspective Expansion of Space	0.6
6	Spatial Relationships	0.2	19	Wall Texture	0.1
7	Space Wall Roughness	0.7	20	Spatial Differentiation	0.8
8	Spatial Guidance and Orientation	0.3	21	Spatial Diversity	0.3
9	Space Proportions and Scale	0.2	22	Opening Placement	0.5
10	Harmony and Balance	0.2	23	Spatial Expansion	0.2
11	Space Height	0.6	24	Spatial Openness	0.7
12	Spatial Composition	0.8	25	Spatial Dynamics	0.2
13	Spatial Continuity	0.8		-	

After completing the first stage of the Delphi process in the initial round, the second stage and the construction of the researcher-made, closed-ended questionnaire were carried out. The questionnaire items were determined based on the 16 components extracted from the first round of the Delphi study. The method of item formulation ensured that each component covered at least two of the three domains—“cognitive, emotional, and behavioral”—

to encompass the diverse perspectives of the experts, using a 10-point Likert scale (0-9). Ultimately, a 50-question questionnaire was developed and distributed to 20 experts. To validate the researcher-made questionnaire, both validity and reliability criteria were employed. To assess the questionnaire’s reliability, Cronbach’s alpha was used. If Cronbach’s alpha is higher than 0.7, the reliability of the questionnaire is considered acceptable (Hoekstra

et al. 2019). In the second-stage researcher-made questionnaire, the Cronbach's alpha coefficient was 0.962, indicating very high reliability. To evaluate the validity of the closed-ended questionnaire developed in the second round of the Delphi process, the questionnaire items were provided to five experts in architecture and environmental psychology. Through this process, both content and face validity were confirmed. Finally, after receiving the experts' perspectives in the second step of the Delphi process, the next step involved categorizing their views on the spatial-physical components influencing spaciousness quality based on Exploratory Factor Analysis (Q). The first step in conducting Exploratory Factor Analysis is to assess sample adequacy using the KMO test and Bartlett's test of sphericity. The value of this test for the present study was 0.748, which is above

0.6 and therefore acceptable. Accordingly, the spatial-physical components could be extracted. The next step in performing an Exploratory Factor Analysis is to rotate the components and determine the number of extracted factors. The number of extracted factors (spatial-physical components related to spaciousness quality) must account for at least 60 percent of the variance of the rotated data (Williams, Onsmann, and Brown 2010). After data rotation, seven factors (seven spatial-physical components) were identified based on experts' opinions. Additionally, the numerical value of data variance was approximately 74%, indicating that about 74% of the experts' responses reflect scientific approaches with consistent and organized tendencies. Meanwhile, the remaining 26 percent represents the degree of personal tendencies and individual preferences in the study (Table 5).

Table 5. Description of the Variance of the Data obtained from the Researcher-Made Questionnaire in the Second Stage of the Delphi Process

Factor	Extracting the Sum of Squared Loads			Sum of Squared Load Rotations		
	Total	Percentage Variance	Cumulative Percentage	Total	Percentage Variance	Cumulative Percentage
1	4.215	21.073	21.073	3.174	15.870	15.870
2	2.956	14.779	35.852	2.407	12.034	27.905
3	2.314	11.571	47.423	2.220	11.099	39.004
4	1.605	8.026	55.449	2.148	10.738	49.742
5	1.336	6.680	62.129	1.791	8.953	58.695
6	1.217	6.086	68.215	1.585	7.927	66.622
7	1.144	5.719	73.935	1.463	7.313	73.935

The scree plot (Fig. 3) also indicates that the appropriate number of factors for rotation is 7. After rotation using the Varimax method, these seven conceptual orientations exhibit a more uniform distribution of factor loadings. Therefore, seven conceptual factors

are included in the researcher-designed, closed-ended questionnaire. This means that, according to the experts, there are seven spatial-physical components influencing the quality of spaciousness.

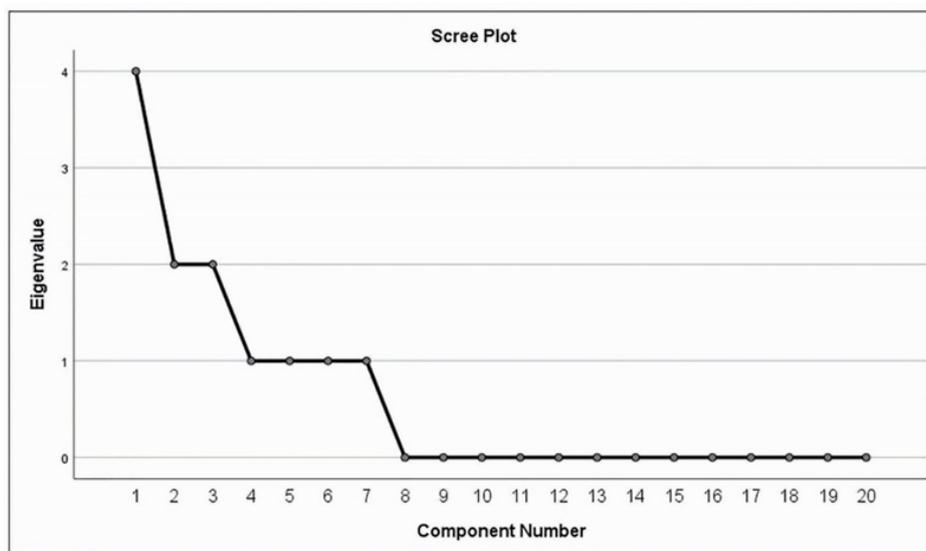


Fig. 3. Scree Plot for the Researcher-Made, Closed-Ended Questionnaire and Confirmation of the Seven Factors

The final step in identifying the spatial-physical components influencing spaciousness quality in apartment housing is the naming of the factors based on the rotated data matrix (Table 6). In this stage, each expert whose factor loading exceeds ± 0.4 (Beavers et al. 2013) is considered significant and assigned

to the corresponding factor. After classifying and identifying experts for each factor based on factor loadings greater than 0.4, the responses of the experts associated with each factor are reviewed to identify shared components within each group.

Table 6. Rotated Data Matrix and its Factor Loadings (Classification of Experts based on their Perspectives)

	Factor						
	1	2	3	4	5	6	7
010 var	0.856	0.144	-0.011	0.198	0.132	0.134	-0.038
002 var	0.777	-0.056	0.382	0.005	0.100	0.150-	-0.007
016 var	0.711	-0.133	0.009	0.067	-0.291	0.137	0.279
014 var	0.638	0.510	0.10	0.012	-0.136	-0.232	0.082
011 var	0.624	0.299	0.040	0.215	0.448	0.100-	0.123
005 var	-0.044	0.839	0.048	-0.087	0.279	-0.012	-0.126
013 var	0.166	0.805	-0.090	-0.041	-0.138	-0.047	0.197
009 var	0.183	0.510	0.151	0.239	-0.082	-0.264	-0.432
001 var	-0.061	0.072	0.794	0.203	-0.096	-0.061	-0.054
004 var	0.299	-0.067	0.730	0.034	0.134	-0.007	0.146
020 var	0.069	0.195	-0.653	0.111	0.388	-0.235	-0.196
018 var	0.414	0.222	0.499	-0.339	0.016	0.312	0.047
003 var	0.034	-0.044	-0.027	0.888	0.108	0.048	-0.102
019 var	0.020	0.014	0.133	0.842	0.139	-0.017	0.140
008 var	0.043	-0.116	0.000	0.161	0.851	0.028	-0.099
006 var	-0.046	0.513	-0.268	0.071	0.646	-0.046	0.127
012 var	-0.037	-0.146	0.011	-0.017	-0.043	0.847	-0.066
015 var	0.131	0.027	0.071	0.533	0.015	0.612	0.040
007 var	0.109	0.066	0.294	0.027	-0.052	-0.020	0.869
017 var	0.357	0.058	0.137	0.089	0.034	0.368	0.489

At this stage, to identify the spatial-physical components influencing the quality of spaciousness from the perspective of experts, each factor (i.e., a spatial-physical component affecting the quality of spaciousness) was named based on the items it encompassed and the shared content among the experts. As shown in the rotated factor matrix (Table 7), the first component is shared among five experts (10, 2, 16, 14, and 11); the second component among three experts (5, 13, and 9); the third component among four experts (1, 4, 20, and 18); the fourth component among two experts (3 and 19); the fifth component among two experts (8 and 6); the sixth component among two experts (12 and 15); and the

seventh component among two experts (7 and 17). Next, the items with the highest scores (9 and 8) for each expert were identified separately. Among the items with the highest expert scores, the shared content of items related to each factor was identified and used as the conceptual basis for that factor. Accordingly, the factors were identified and named (Table 7). In addition, to validate the naming of the factors, feedback was obtained from five specialists in architecture and environmental psychology, and each expert's opinion was taken into consideration in naming the factors.

Table 7. Naming of Spatial-Physical Components Influencing the Quality of Spaciousness based on the Shared Content of Items among Experts

Introducing the Factor	Everyday Items among Experts in each Factor	Content of Common Items	Factor Naming
First Factor	1-7-12-18-23	This factor includes five everyday items, each with 10-point Likert-scale responses, across five experts. The common theme among these factors is lighting, semi-open spaces, and natural light in walls and ceilings to create spaciousness in apartment interiors. The interpretation of this item indicates that the content of this item is close to the brightness of the space.	Space Lighting
Second Factor	6-12-14-16-42-43-47-50	This factor comprises eight items with 10-point Likert-scale responses from three experts. The common theme among these factors emphasizes window design, natural light in the walls and ceilings, and the potential to create a visual connection to the outside to foster a sense of spaciousness in apartment interiors.	Open Space View
Third Factor	7-8-12-15-30	The content of the items emphasizes the presence of semi-open space, the creation of windows, and the creation of a terrace. The content of the items all focuses on the view from the closed space to the open space, the possibility of spatial expansion, and the absence of blockages to create a sense of spaciousness.	Spatial Openness
Fourth Factor	5-13-25-31-34-41-43	All eight everyday items among experts emphasize space changes based on users' needs and the diversity of those needs over time. Therefore, given the items' content, the fourth factor was named the flexibility component.	Flexibility
Fifth Factor	6-16-20-21-23-42-46	The common content of the items comprising the fifth factor emphasizes the necessity of maintaining openings, their placement, and creating light from the walls to achieve a sense of spaciousness.	Opening Organization
Sixth Factor	5-8-16-26-28-29-31-45-49	The common content of these items focuses on expanding visual communication by eliminating walls and avoiding interruptions in space through joints, thereby creating a sense of spaciousness in apartment interior spaces.	Spatial Continuity
Seventh Factor	9-14-27-33	The common content of these items emphasizes the proportions of the floor-to-ceiling heights of the spaces to create a sense of spaciousness.	Floor and Ceiling Proportions

What is worth considering in relation to the quality of spaciousness in the present study is the explanation of the components of the quality of spaciousness in relation to the interior space of housing and its relationship with improving the quality of the interior space of housing. Studies conducted on the explanation of the components of the quality of spaciousness in the present study show that among the 9 physical components expressed based on the studies conducted (components of space area, space lighting, floor proportions, unevenness of walls, height of spaces, permeability of walls, furniture arrangement, texture of walls and placement of openings) in relation to the quality of spaciousness, six components of “space structure, height of spaces, unevenness of walls, permeability of walls of spaces, texture of walls and walls and furniture arrangement” are not considered components of the quality of spaciousness in the interior space of apartment housing from the perspective of the experts in the present study. However, what is important in relation to the physical is the improvement of physical elements in order to

meet the needs of the residents, which is possible through attention to spatial components and their combination with physical components. Therefore, in the present study, the components of spaciousness quality have been explained more precisely and completely in order to improve the quality of the interior space.

5. CONCLUSION

The present study aimed to understand the spatial-physical components influencing spaciousness quality from the perspective of experts, thereby clarifying the components related to spaciousness quality and optimizing the quality of interior space for residents. Spaciousness quality seeks to create desirability in interior space for residents by making the space appear larger, ultimately leading to resident satisfaction. Most studies on spaciousness quality have focused more on physical components and less on spatial components. However, what is essential regarding the physical form is attention to spatial

components, which results in optimal housing and the meeting of residents' needs. Based on the findings of the present study, it can be stated that the use of spatial-physical components such as spatial lighting, view to open space, spatial openness, flexibility, organization of openings, spatial continuity, and floor-to-ceiling proportions can improve the quality of interior space for residents and enhance their perception

of the interior environment. Each of the obtained components, according to experts' perspectives, has specific effectiveness criteria that should be considered to achieve spaciousness quality in the interior space of apartment housing. Accordingly, to better interpret the research findings, the effectiveness criteria of each spatial-physical component, as determined from the experts' viewpoints, are presented (Table 8).

Table 8. Spatial-Physical Components Influencing Spaciousness Quality and their Respective Criteria

Row	Factor	Criteria for Creating each Factor
1	Space Lighting	Increasing the lighting of spaces (natural or artificial), the possibility of lighting from walls and ceilings
2	Outside View	Considering openings for interior spaces, especially the reception area, and using floor-to-ceiling windows. Taking advantage of the view of openings to the outside space
3	Spatial Openness	Designing semi-open spaces, including terraces, expanding spaces, and not blocking spaces in the interior of apartment housing
4	Flexibility	The possibility of combining and separating two spaces (reception and living room, or kitchen and living room), an open-plan interior design, and not using columns in the interior space. Using small and light furniture in the living room and bedroom
5	Opening Organization	Placement of windows in the corners of the walls, the necessity of maintaining openings and lighting from them, to create a quality of spaciousness
6	Spatial Continuity	Designing the kitchen as an open space, not blocking the view to the interior spaces and allowing for spatial expansion, not using too many partitions in the interior space, using the corridor to separate the public area from the semi-public (semi-private) area, using a showcase or library in the living room
7	Floor and Ceiling Proportions	Designing the bedrooms as wide, the difference in level between the living room and kitchen spaces, and other spaces

The present study, drawing on previous research and recognizing the lack of influential studies on improving the quality of apartment interiors, aimed to enhance the quality of apartment interiors through the application of spaciousness quality. The study identified seven components—spatial lighting, view to open space, spatial openness, flexibility, organization of openings, spatial continuity, and floor-to-ceiling proportions—as essential for improving the quality of interior spaces in housing. For future research, it is recommended that, based on the identified

components, efforts focus on developing models, exploring the relationships and cycles within these models, and extracting their patterns. Additionally, future studies could be conducted in a cross-cultural context or in different cultures and regions to enable a deeper understanding of how spaciousness quality and its components are perceived in interior housing spaces from the perspective of residents across diverse cultural backgrounds.

ACKNOWLEDGMENTS

This article wasn't supported by any financial or spiritual sponsors.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

MORAL APPROVAL

The authors commit to observe all the ethical principles of the publication of the scientific work based on the ethical principles of COPE. In case of any violation of the ethical principles, even after the publication of the article, they give the journal the right to delete the article and follow up on the matter.

PARTICIPATION PERCENTAGE

The authors state that they have directly participated in the stages of conducting research and writing the article.

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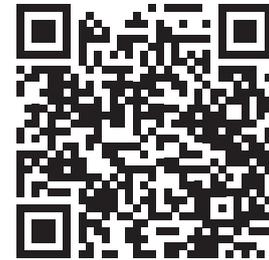
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HOW TO CITE THIS ARTICLE

Chegeni, Farhad, Mohsen Afshari, and Bahram Saleh Sadeghpour. 2025. Identification of the Spatial-Physical Components of Spaciousness Quality in the Interior Space of Apartment Housing Based on Experts' Perspectives. *Armanshahr Architecture & Urban Development Journal* 18(52): 1-14.

DOI: 10.22034/AAUD.2025.501860.2947

URL: https://www.armanshahrjournal.com/article_232893.html

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